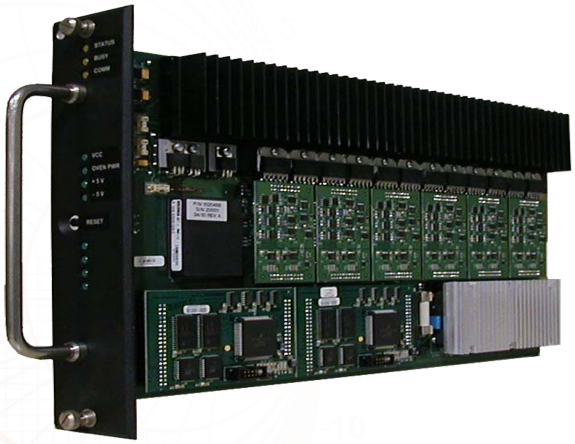
HIEM

High-Current EM
4 A / 10 V



DATA SHEET

Cascade Microtech's High-Current Electromigration Module (HIEM) is designed for electromigration (EM) and stress migration (SM) testing of 3D interconnects, such as solder bumps, copper pillars and through-silicon vias, and other large geometry metal structures.

The HIEM Module utilizes dedicated high-accuracy source measurement units (SMU) to measure each DUT independently without scanning. For low resistance devices, built-in, auto-ranging Wheatstone Bridges (WSB) ensure a precise detection of small changes. The Wheatstone Bridge circuit is widely recognized as the most effective method of measuring low resistance devices. For higher resistance structures, the SMU can run in traditional SMU mode. Based on the resistance measurements, the software automatically switches between SMU and WSB modes. DUT temperatures are reported using the traditional TCR method and also with the DUT Temperature Monitor circuit.

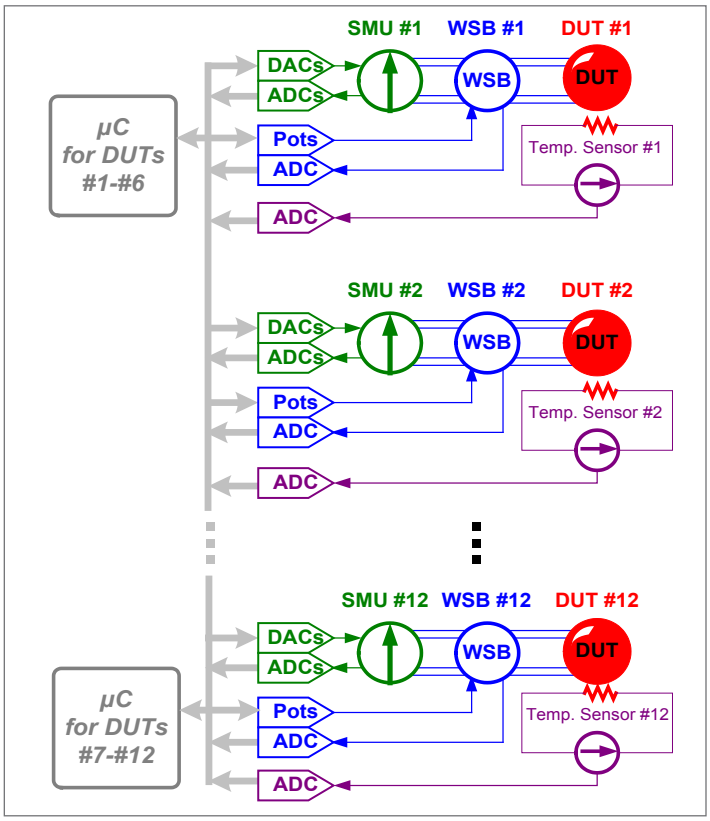
With an intuitive, full-featured test suite, EM and SM experiment data is analyzed quickly to determine DUT failure times. The data analysis tools offer full Black's Equation evaluation for accurate lifetime projections with confidence intervals. All data can easily be exported to other applications for analysis.

FEATURES / BENEFITS

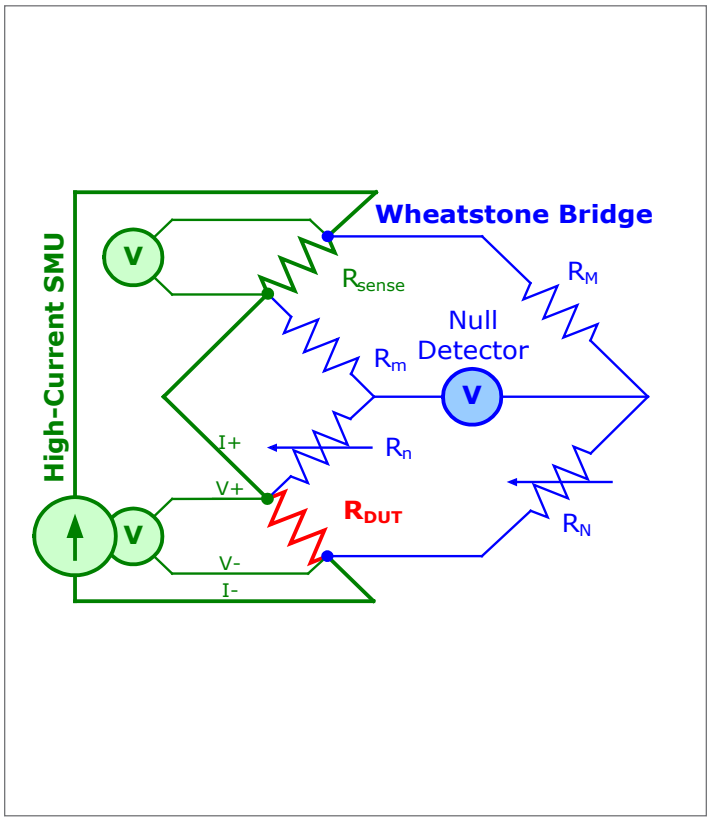
Flexibility	Compatible with both 1164 and Symphony™ reliability test systems Broad measurement range with measurements up to 4 A per DUT Accurate WSB measurement system for low resistance devices One temperature monitor per DUT Full-featured test suite, including EM, TCR, and SM
Full parallel measurements	Dedicated high-accuracy SMU for each DUT Continuous monitoring of all DUTs — no scanning Instant capture of momentary DUT behavior Quick disconnect upon DUT failure 4-wire Kelvin connections
Maximum efficiency	Industry's best package-level test throughput with 1164 Highly parallel wafer-level reliability testing with 1164 or Symphony

CascadeMicrotech®

12 SMUs	One per DUT Including current source, ammeter and voltmeter To independently source current for each device Continuously measure the current through and voltage across, each DUT without scanning through a switch matrix Provides 4-wire Kelvin bias and measurement Six SMUs are capable of up to 4A per DUT The other six can source up to 2A per DUT
12 Wheatstone Bridges	One per DUT To independently measure resistance for each device when DUT resistance is below 1 Ω Wheatstone Bridges are continuously monitored (no scanning)
12 DUT temperature monitors	One fixed 100 µA source per DUT paired with one sensor voltmeter per DUT To continuously monitor DUT temperature on an optional sensor line



Full parallel measurement system: dedicated SMUs and built-in WSBs, one each per DUT.



The Wheatstone Bridge provides high-accuracy measurements of low resistance DUTs.

SPECIFICATIONS

Parameter	Specification
Capacity	Up to 12 DUTs
Maximum current	+1 A per DUT (10 V compliance, up to 12 DUTs, 5 mΩ - 100 kΩ) +2 A per DUT (8 V compliance, up to 6 DUTs, 1Ω - 100 kΩ) +2 A per DUT (2.5 V compliance, up to 12 DUTs, 5 mΩ - 100 kΩ) +4 A per DUT (2.5 V compliance, up to 6 DUTs, 5 mΩ - 100 kΩ)
Source resolution	100 µA (40 mA – 4 A) 1 µA (below 40 mA)
Source accuracy	0.1 % ± 500 µA (40 mA – 4 A) 0.1 % ± 50 µA (below 40 mA)
Maximum voltage	10 V (set points up to 1 A, up to 12 DUTs, 5 mΩ - 100 kΩ) 8 V (set points up to 2 A, up to 6 DUTs, 1 Ω - 100 kΩ) 2.5 V (set points up to 2 A, up to 12 DUTs, 5 mΩ - 100 kΩ) 2.5 V (set points up to 4 A, up to 6 DUTs, 5 mΩ - 100 kΩ)
Maximum DUT power	5 W per DUT
DUT measurement range	5 mΩ ~ 100 kΩ
Measurement resolution (WSB mode for R ≤ 1 Ω)	For set points >100 mA: 620 µΩ (440 mΩ – 1 Ω) 270 µΩ (190 mΩ – 440 mΩ) 120 µΩ (80 mΩ – 190 mΩ) 50 µΩ (35 mN – 80 mΩ) 22 µΩ (15 mN – 35 mΩ) 10 µΩ (below 15 mΩ) WSB accuracy not specified for set points <100 mA.
Measurement accuracy (WSB mode for R ≤ 1 Ω)	For set points >100 mA: 0.1 % ± 3 mΩ (440 mN – 1 Ω) 0.1 % ± 1.3 mΩ (190 mN – 440 mΩ) 0.1 % ± 570 µΩ (80 mN – 190 mΩ) 0.1 % ± 240 µΩ (35 mN – 80 mΩ) 0.1 % ± 100 µΩ (15 mN – 35 mΩ) 0.1 % ± 50 µΩ (below 15 mΩ) WSB accuracy not specified for set points <100 mA.
Measurement resolution (SMU mode for R > 1 Ω)	1.25 µV (625 mV – 10 V) 75 nV (below 625 mV) 5 µA (40 mA – 4 A) 500 nA (below 40 mA)
Measurement accuracy (SMU mode for R > 1 Ω)	0.1 % ± 500 µV (625 mV – 10 V) 0.1 % ± 50 µV (below 625 mV) 0.1 % ± 200 µA (40 mA – 4 A) 0.1 % ± 20 µA (below 40 mA)
Acceptable DUT temperature monitors (feature of customer structure)	• Linear voltage vs. temperature characteristic under fixed 100 µA constant current bias (e.g. resistive metal stripe or diode) • ≥50 mV at 100 µA bias and room temp, and ≤625 mV at 100 µA and maximum DUT temperature (incl. self-heating) (i.e. 500Ω-6,250Ω)
DUT temperature monitor measurement accuracy	0.5 % ± 5 Ω (e.g. DUT Temperature Monitor accuracy is approximately ± 3°C for linear temp. sensor with R = 1,000 Ω at room temp. and TCR ~0.003 and characterized across 50°C - 150°C during TCR and self-heated DUT temp. of 200°C)
Measurement sampling	<0.1 sec

*Data, design and specification depend on individual process conditions and can vary according to equipment configurations.
Not all specifications may be valid simultaneously.

RECOMMENDED OPERATING RANGE

Current set-point range	1 mA ~ 4 A
Voltage measurement range	1 mV ~ 10 V
DUT resistance measurement range	5 mΩ ~ 100 kΩ
DUT power range	Up to 5 W per package

REGULATORY COMPLIANCE

Certification	CE, SEMI S2

WARRANTY

Warranty*	Fifteen months from date of delivery or twelve months from date of installation (whichever comes first)
Service contracts	Single- and multi-year programs available to suit your needs

*See Cascade Microtech's Terms and Conditions of Sale for more details.

ORDERING INFORMATION

Consult factory for more detailed specifications, additional options, suitability of configuration for intended usage, part numbers, pricing, and delivery.

HIEM-DS-0715

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